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VISION 2000: CONTROL CENTER SYSTEM RE-ENGINEERING

Design Concept for Maintaining and Upgrading the Ground System (MUGSy) and Office Environment

March 1996

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Design Concept for Maintaining and Upgrading the Ground System (MUGSy) and Office Environment

March 1996

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Section 1. Introduction

1.1 Purpose

The purpose of this document is to set a design framework or concept for Maintaining and Upgrading the Ground System (MUGSy) and Office Environment which can be used as a basis for feedback from the user community, for the prototyping efforts, a detailed design, and the implementation of an operational system.

1.2 Background

MUGSy is envisioned to be a system that will automate the process for change management, configuration management, procurement management, test management, and documentation/information management. It will handle a change request from its inception to the installation of the change. It and the new process it supports, will replace today's manually intensive processes and procedures as much as possible.

1.3 Scope

This document specifies a conceptual design, a preliminary release plan, and a recommendation for COTS products for release 1 based on the Derived Logical Processes (DLP) and the COTS software evaluations.

1.4 Reference Documents

A list of reference documents is as follows:

- a. *Commercial Off The Shelf (COTS) Software Evaluation Report for Maintaining and Upgrading the Ground System (MUGSy)*

1.5 Content

This document is composed of the following:

- a. Section 2 specifies the design concept.
- b. Section 3 specifies the preliminary release plan.
- c. Section 4 specifies the COTS products recommended to use in the prototype.

Section 2. Design Concept

2.1 Overall Design

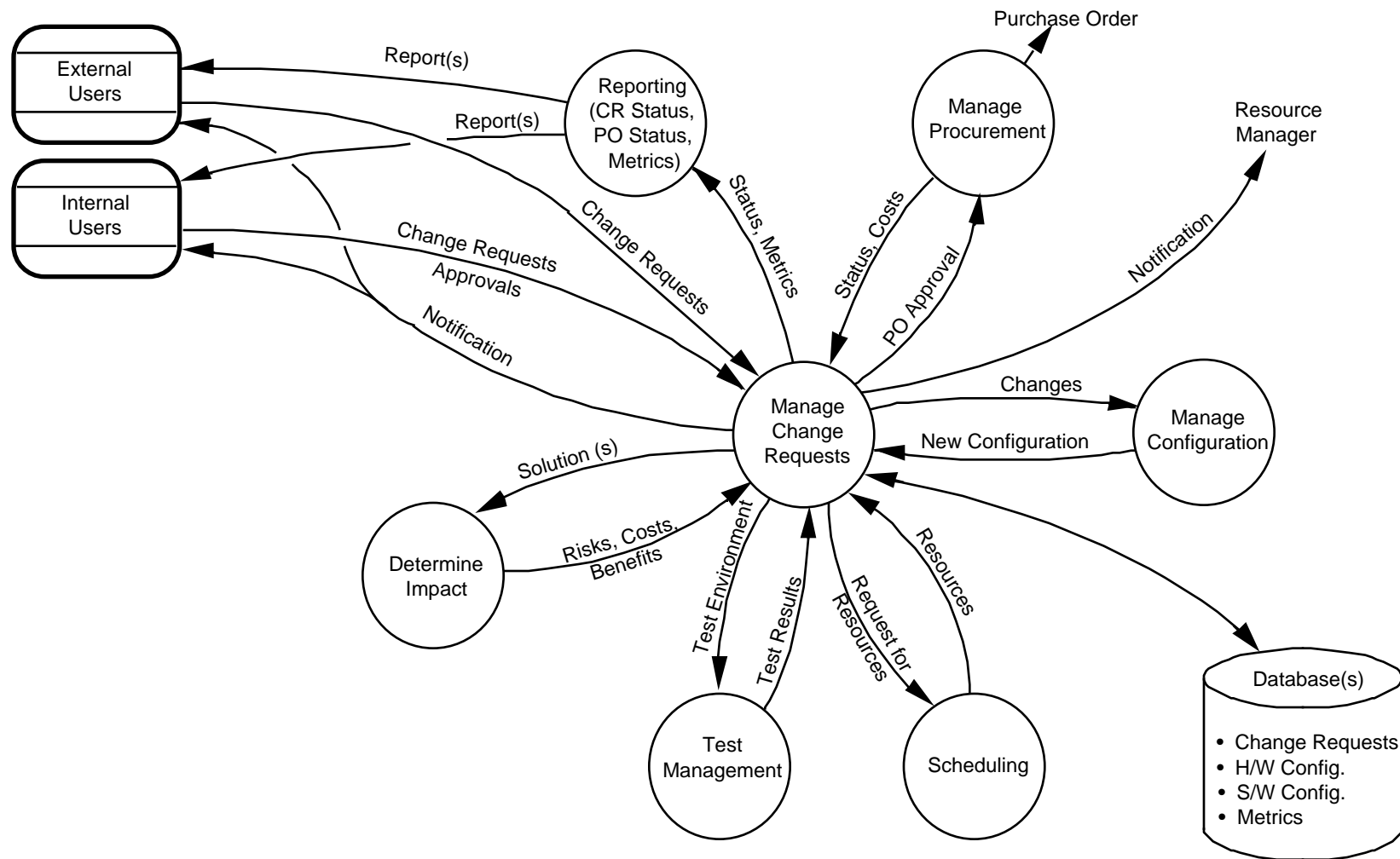
Based on the DLP's, MUGSy has been divided into eight major functional areas or modules. See *Figure 2-1. MUGSy Application Map*. The major functional modules of MUGSy are as follows:

- a. Change Request Management Module
- b. Impact Assessment Module
- c. Configuration Management Module
- d. Procurement Management Module
- e. Test Management Module
- f. Scheduling Module
- g. Reporting and Communications Module
- h. Electronic Software Distribution Module

2.1.1 Change Request Management Module

The Change Request Module will manage a Change Request (CR) and its related information as it flows through the end-to-end process, from the time it is submitted until it is closed. This module would include the following:

- a. Validating the user and user permissions - When a MUGSy user logs on, their user name and password will be validated against the allowable MUGSy users. If they are not a recognized user, an error message will be provided.
- b. Assigning CR identification numbers - Each CR will be assigned a unique, sequential identification number. This number will be used to track the CR throughout the entire change process by the Change Request Management module.
- c. Validating CR's - A minimum set of information will always be required to enter a CR into MUGSy. The minimum set of information will be compared against a "standard set of parameters to ensure consistent reporting and tracking."
- d. Tracking CR status - A CR will be tracked, by the Change Request Management Module, from initial entry into MUGSy until installation against predefined "progress points." A candidate set of progress points include CR identified, CR assigned (to a particular engineer to ensure completion), CR dependencies identified, CR impacts identified, CR solutions identified, CR approved for implementation (OR REJECTED), CR changes completed, CR information updated, CR successfully tested, CR ready for installation, CR installed, CR in use operationally (OR BACKED OUT).
- e. Ensuring appropriate approval levels - A predefined set of "approval authority" (for proceeding with implementation and installation) will be established based on the complexity of a CR. A CR can be approved by the "person assigned to ensure completion" who will typically be a technical person or only by the Operations Manager (if it is a very complex CR requiring changes to external interfaces).



MUGSyMAP.drw 2-8-96 Gary Orr

Figure 2-1. Maintain and Upgrade the Ground System (MUGSy) Application Map

- f. Collecting metrics - MUGSy will automatically “time stamp” completion at each of the progress points. Standard metrics will be generated from this information against each CR.

2.1.2 Impact Assessment Module

The Impact Assessment Module will determine the impact of any given CR based on its dependencies and on the overall ground system or office environment. This module would consist of the following:

- a. Identifying dependencies - All dependencies will be identified. Dependencies include information (design, code, data, operational procedures, test scripts, organization, technology (computers and networks), and external interfaces.
- b. Assessing solutions impacts - Each solution submitted will be assessed against the set of dependencies to ensure that each dependency has been addressed for completeness.
- c. Determining and reporting of effort, time, risks, and benefits - Each proposed solution against a CR will be assessed to project the impact to schedule, level of effort, risk, and benefit.
- d. Supporting decision making - Each proposed solution and its resultant impacts will be assessed to support the selection of the best solution.

2.1.3 Configuration Management Module

The Configuration Management Module will manage the hardware, software, documentation, and baselines (development, test, and operational) for the ground systems and office environment. This module would include the following:

- a. File check in/out - Each file will be "checked out" in order to have the capability of modifying it; this also provides accountability and traceability as to who was the last person to modify this file. Likewise, the file would then be "checked in" when the user is completed making modifications to the file. Therefore, allowing another user access to the file.
- b. File locking - Upon a user checking out a file, the file is locked to prohibit other users from modifying the same file at the same time.
- c. Version control - In order to provide a tracking mechanism a version number is assigned to each file, therefore, providing a method to maintain control of any given file. This also provides quick-look capabilities to determine which file is most current file.
- d. Manage the development baseline(s) - The baseline during the development phase manages all files as a set, providing the user with the latest set of files at all times. If for any reason the user needs to move backward in the development phase, they may do so using previous development baselines.
- e. Manage the test baseline(s) - The baseline during the test phase manages all files as a set providing the user with the version of files or set being tested at all times.
- f. Manage the operational baseline(s) - The baseline during operations manages all files as a set providing the user with the version currently used during operations at all times.

2.1.4 Procurement Management Module

The Procurement Management Module will manage and track the status of any procurements which were necessary for any given CR. This module will consist of the following:

- a. Assignment of Purchase Request Number - Each Purchase Request will be assigned a unique, sequential purchase request number that will be used internally to track the Purchase Request throughout the “internal purchase process” (TBD) to allow users to track the progress. A purchase request number will be related to the CR identification number .
- b. Assignment of Purchase Order Number - Each Purchase Order will be assigned a unique, sequential purchase request number that will be used externally track the Purchase Order throughout the “external purchase process” (TBD) to allow users to track the progress. A purchase order number will be related to the CR identification number .
- c. Vendor and contact information - Vendor profile information will be created and maintained to facilitate timely communication with potential vendors.
- d. Status of purchase at each step in the process - A Purchase Order will be tracked, by the Change Request Management Module, from initial entry into MUGSy until receipt of the requested item(s), against predefined progress points.

2.1.5 Test Management Module

The Test Management Module will provide the tools to support the test planning, test status, and test environment. This module will consist of the following:

- a. Test planning - The tools to develop and maintain traceability matrices, test threads and associated test scripts, test data identification (source) and expected results will be provided.
- b. Test setup - The tools to specify and create the test environment will be provided.
- c. Test execution - The tools to control test execution will be provided.
- d. Test data collection and analysis: The tools to collect test execution results at predefined “test points”, and to compare or to analyze the results will be provided.
- e. Test reporting - The tools to generate test reports from the test analysis results will be provided.
- f. Test status - Testing activities will be tracked, by the Change Request Management Module, against predefined “test progress points”.

2.1.6 Scheduling Module

The Scheduling Module will manage the resources for implementation and installation for the final solution or change to the ground system or office environment as a result of any given CR. This module will consist of the following:

- a. Scheduling resources to implement change - The tools to assess personnel workload against the time and effort required to implement a CR will be provided. This tool will utilize existing “work assignments” and planned absences to determine the personnel most available to implement the CR.
- b. Scheduling CR's for implementation - The tools to determine, when a CR will be completed (based on estimated level of effort and duration) and projecting a time to install the CR for operational use (considering HST activities), will be provided.

2.1.7 Reporting/Communications Module

The Reporting/Communications Module will consist of the management of all reports necessary for management review and the communications throughout the life of any given CR. This module will consist of the following:

- a. Generation of reports (including metrics) - Ad-hoc reports and predefined reports generated for management and communications. Pre-defined reports will then automatically be distributed to the appropriate personnel.
- b. Notification of CR assignments - Automatically notify, via E-mail to both the CR coordinator, CR Assignee, and if necessary the CCS Coordination Team (CCT) of CR assignments.
- c. Notification of CR approvals - Automatically notify, via E-mail, interested parties of the approval of a CR for implementation or installation.
- d. Notification of CR implementation - Automatically notify, via E-mail, interested parties of the stages (i.e., development, testing) of the CR implementation.
- e. Notification of CR installation - Automatically notify, via E-mail, interested parties of the CR installation into the operational system.
- e. Notification of CR problems - Automatically notify, via E-mail or pager the CR coordinator, CR Assignee, and if necessary the CCT of new CR problems submitted to MUGSy.
- f. Notification of CR status - Automatically notify, via E-mail, interested parties of the status (i.e., development, testing) of the CR as it flows through the implementation process.
- g. Posting information to the WWW - Automatically post CR information (i.e., CR problem, solution, status) to the WWW as it flows through the process.

2.1.8 Electronic Software Distribution Module

This module will most likely evolve as we continue through the development cycle, however, the idea behind this module is to distribute or move software automatically through the implementation process. For example, after the development is complete the software or change set is automatically distributed to the testing environment, and when testing is complete (given certain criteria) the software or change set is automatically distributed or installed into the operational environment.

2.2 Control Flow and Module Interfaces

2.2.1 Control Flow

The control flow diagram shown in *Figure 2-2. MUGSy Design Concept* illustrates an overview of the design concept and the Module Interfaces.

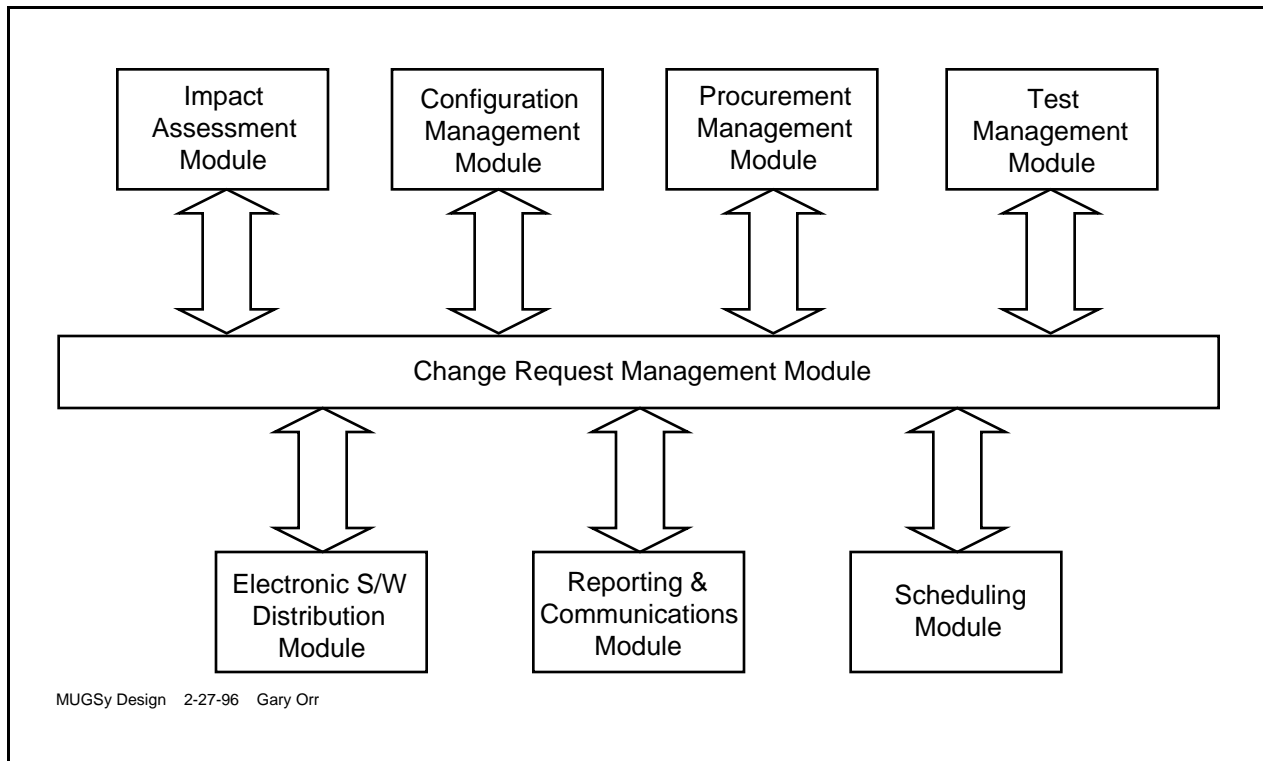


Figure 2-2 MUGSy Design Concept

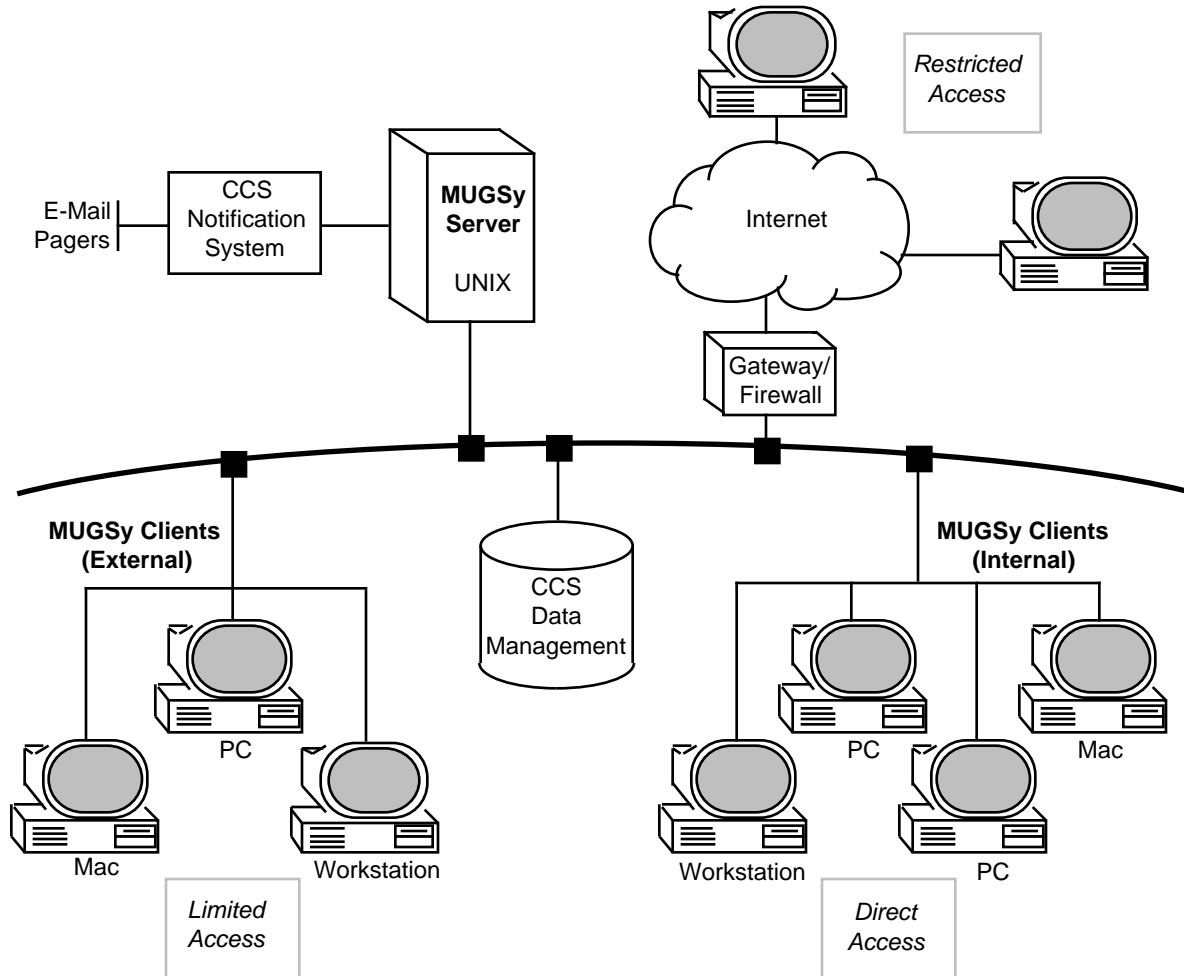
2.2.2 Module Interfaces

Each module will interface with the main Change Request Management Module which manages each Change Request (CR) from end-to-end. Each of these interfaces will be implemented through one of the following:

- a. Application Program Interface (API)
- b. Dynamic Data Exchange (DDE)
- c. Script files
- d. Custom code

2.3 Physical Architecture

The conceptual physical architecture for Maintaining and Upgrading the Ground System (MUGSy) is reflected in Figure 2-3. MUGSy Physical Architecture Concept.



MugPhArc.dwg 2-12-96 Gary Orr

Figure 2-3 MUGSy Physical Architecture Concept

Section 3. Preliminary Release Plan

3.1 Preliminary Release Plan

In order to support the overall CCS release schedule, MUGSy releases will need to precede CCS releases. MUGSy has also been divided into three release phases. The functions which will be available in each release are detailed in the paragraphs below. For a preliminary release schedule for MUGSy refer to Figure 3-1. MUGSy Preliminary Release Schedule.

3.1.1 Release 1

The following modules will be implemented in Release 1.

- a. Change Request Management Module
- b. Configuration Management Module
- c. Reporting and Communication Module
- d. Test Management Module (Part 1)
- e. Electronic Software Distribution Module (Part 1)

3.1.2 Release 2

The following modules will be implemented in Release 2.

- a. Scheduling Module
- b. Test Management Module (Part 2)
- c. Electronic Software Distribution Module (Part 2)

3.1.3 Release 3

The following modules will be implemented in Release 3.

- a. Impact Assessment Module
- b. Procurement Management Module

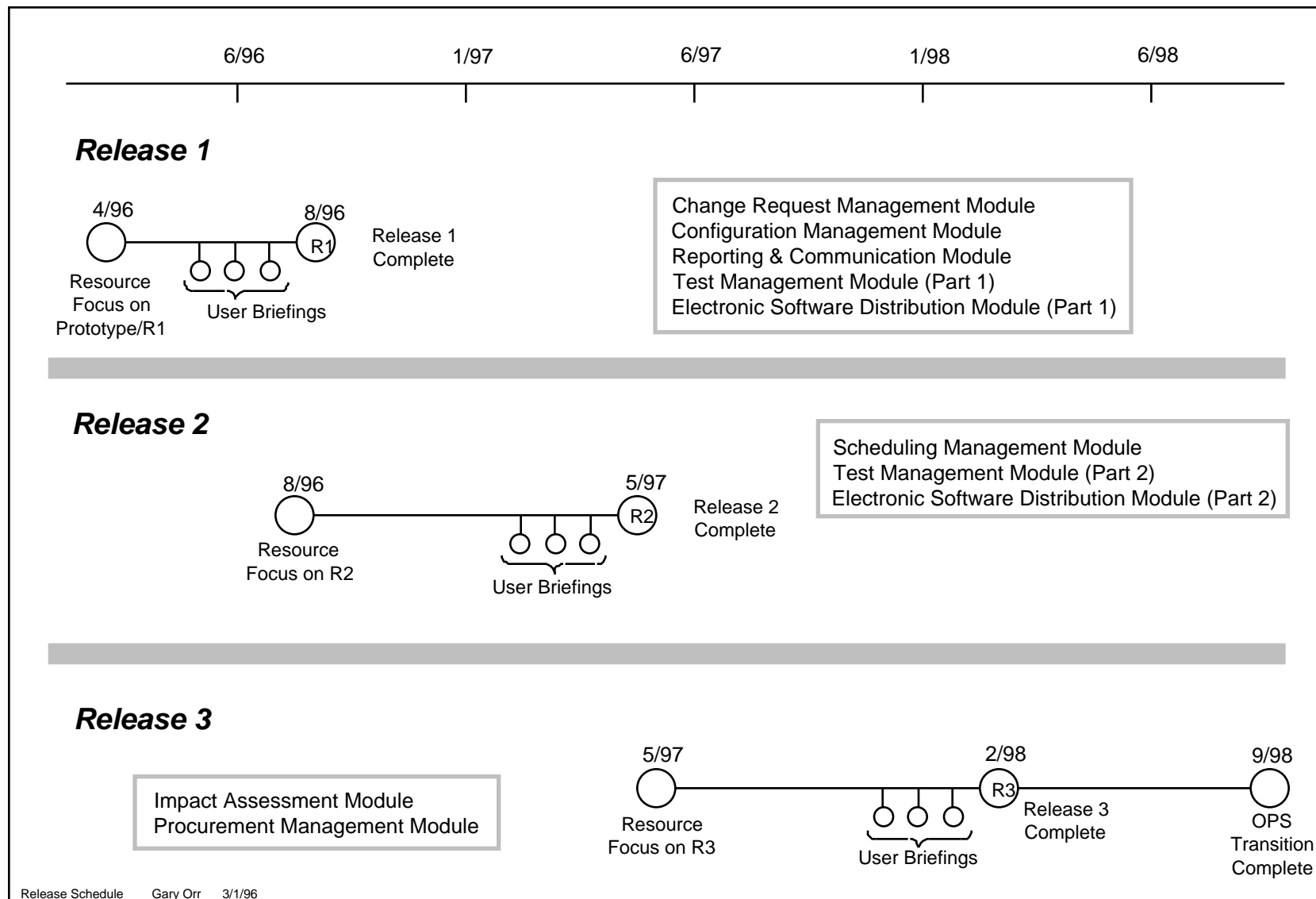


Figure 3-1. MUGSy Preliminary Release Schedule

Section 4. Recommendation

4.1 Prototype Recommendation

The most critical MUGSy capabilities required to support CCS Release 1 are the Change Management Module and the Configuration Management Module. To date, COTS evaluations, have focused on these areas. The candidate COTS product for the Change Management Module is QualityTeam/WebTeam and the Configuration Management Module COTS product is Aide-de-camp/pro. For further details on the COTS evaluations see section 4.2 and 4.3 or the COTS Evaluation Report for MUGSy. The QualityTeam/WebTeam and Aide-de-camp/pro products should be used to begin MUGSy prototyping efforts as soon as possible. As COTS products are selected for the remaining MUGSy capabilities for Release 1, they should be added to the prototyping effort.

4.2 Configuration Management Module

4.2.1 COTS Product Comparison

The top three contenders in Software Configuration Management (SCM) are ClearCase by Atria, Aide-de-camp/pro by True Software and Continuous/CM by the Continuous Software Corporation. ClearCase and Aide-de-camp/pro are designed specifically for software configuration management. Continuous/CM is also designed for software configuration management but has additional capabilities for defect tracking. The defect tracking functions are better implemented separately by a COTS product designed specifically for change request and defect tracking (i.e., Scopus or Remedy). In terms of configuration management, ClearCase and Continuous/CM take a similar approach, using sequential file version archiving and management. Aide-de-camp takes a object-oriented approach where the fundamental unit of archiving and management is the change or collection of changes. ClearCase is a well-known tool used in the industry. Aide-de-camp has a solid customer base and is gaining popularity and recognition due to its process approach. Therefore, the two SCM packages compared herein are Aide-de-camp and ClearCase.

ClearCase stores all version-controlled data in permanent Version Object Bases (VOBs) which include all files and directories associated with particular development or release. In addition to the files and directories, ClearCase can store attributes and standard information as meta-data for a complete reporting and audit trail. Aide-de-camp stores and controls all changes in a Change Set. Aide-de-camp automatically monitors and permanently stores all changes to any file and annotations associated with the change in this Change Set. Aide-de-camp tracks text files, including source files written in any programming language, using line-by-line differences. It also tracks binary files using byte-by-byte-differences. In addition to standard information, Aide-de-camp, like ClearCase, captures titles, references annotations, and relationships.

ClearCase VOBs can provide a good control over changes; however, Aide-de-camp automates the process of the change control and provides an easy way to audit and track all the changes. Aide-de-camp has more advanced capabilities and depends less on the accuracy of manual inputs. Aide-de-camp has the capability to create an independent Change Set for an outside contractor or vendor that can be integrated into the configuration process. The Change Set is an easy tool to control third party software modifications and upgrades.

ClearCase and Aide-de-camp both have strong support for parallel development and software merging. Both of these tools can support analysis in the differences of like files. However, Aide-de-camp incorporates a version merge and automatically detects conflicts between files. Aide-de-camp also supports change migration from release to release with automatic conflict detection and includes language scanners for impact analysis, dependency checking, reporting, and CM metrics reports. Aide-de-camp and ClearCase both have GUI and command line capabilities; however, Aide-de-camp features more desirable options in the GUI than ClearCase.

4.2.2 COTS Product Recommendation

Based on a thorough review of Aide-de-Camp, Vision 2000 project documentation, MUGSy DLP's or requirements, Aide-de-Camp capabilities discussions, and a Aide-de-Camp capability demonstration, recommend an evaluation copy of Aide-de-Camp be acquired for the prototype system to support software version-control and software configuration management activities.

4.3 Change Request Management Module

4.3.1 COTS Product Comparison

The top contenders in Change Management Module are QualityTeam by Scopus Technology, Action Request System (ARS) by Remedy Corp. and Clear Desk by Clarify Inc. All three tools are specifically designed to automate the change request management, problem resolution and other functions that take place in the process of developing, maintaining, and upgrading of enterprise systems and products. The Clarify Inc. declined to provide a demonstration and discussion of their products because MUGSy was not a large enough of a sale. This obviously excluded Clear Desk from the final evaluation list. Therefore, the two change management packages compared herein are the QualityTeam and ARS.

In terms of similarity, the QualityTeam and ARS are well known tools and are gaining popularity as "Help Desk", Problem Management or Service Management tools. Both of the tools have the main share of their market although the Scopus has a bigger share. Both tools have an open client/server architecture and can be implemented on a variety of popular platforms. Both tools have a sound foundation and use as a repository, a commercially available RDBMS (Sybase, Oracle) and have a set of specifically designed GUI to the RDBMS which can be changed and customized and tailored to the MUGSy environment. Both tools tend to address the same functionality: problem registration, problem tracking, workflow control and management, automatic conflict and status notification.

The differences in the products are mainly their design and implementation approach. ARS was initially designed as a set of tools to organize and to support the problem tracking of HP networks. Later, ARS was expanded to the other applications and came on the market as a shell and a set of tools that could help the user to implement, define change management requirements. ARS consists primary of an executable part and administrative part. The administrative part allows the administrator to define all the information and rules which are used to modify the executable program. The ARS philosophy is to incorporate other products to implement necessary functions. Scopus was initially designed as a product targeted at the change management market. Scopus has well-defined modules. Each module focuses on a specific area. QualityTeam handles problem tracking, WebTeam is an interface to the World Wide Web. InformTeam is the business rules engine used for easy workflow automation. DesignTeam enables data driven modification to forms and screens without programming. Scopus also can be easily integrated with other COTS products to provide additional functions;

for example, other organizations have integrated with Aide-de-camp/pro. Scopus appears as a more finished and robust product with more built-in functions and options which appears to require less effort to implement common change management functions.

4.3.2 COTS Product Recommendation

Based on a thorough review of QualityTeam/WebTeam, Vision 2000 project documentation, MUGSy DLP's or requirements, QualityTeam/WebTeam capabilities discussions, and a QualityTeam/WebTeam capability demonstration, the MUGSy team recommends that an evaluation copy of QualityTeam/WebTeam be acquired for the prototype system to support tracking CR status, collecting metrics, posting CR information to the WWW, notifying personnel, and managing the overall CR process.

4.4 Reporting/Communications Module

Based on a thorough review of QualityTeam/WebTeam, Aide-de-Camp, Vision 2000 project documentation, MUGSy DLP's or requirements, QualityTeam/WebTeam and Aide-de-Camp capabilities discussions, and QualityTeam/WebTeam and Aide-de-Camp capability demonstrations, it is determined that the capabilities of QualityTeam/WebTeam and Aide-de-Camp will satisfy the requirements of this module.

4.5 Test Management Module

No recommendation is available for the implementation of the Test Management Module.

4.6 Scheduling Module

No recommendation is available for the implementation of the Scheduling Module. This module is scheduled for Release 2.

4.7 Impact Assessment Module

No recommendation is available for the implementation of the Impact Assessment Module. This module is scheduled for Release 3.

4.8 Procurement Management Module

No recommendation is available for the implementation of the Procurement Management Module. This module is scheduled for Release 3.

4.9 Electronic Software Distribution Module

No recommendation is available for the implementation of the Electronic Software Distribution Module.

Abbreviations and Acronyms

API	Application Programming Interface
CCS	Control Center System
CCT	CCS Coordination Team
CR	Change Request
CM	Configuration Management
COTS	Commercial Off The Shelf
DDE	Dynamic Data Exchange
DLP	Derived Logical Process
GUI	Graphical User Interface
MUGSy	Maintain and Upgrade the Ground System
RDBMS	Relational Data Base Management System
SCM	Software Configuration Management
VOB	Version Object Base
WWW	World Wide Web

Glossary

change request	A change request is an electronic request made by a user requesting a change, reporting a problem, or suggesting an enhancement to the ground system or office environment.
derived logical process	A derived logical process (DLP) is a process that is completely automated, performed in support of one user, is or could be completed at one time, and easily visualized as a single program or as a closely related group of screens.